LWG
LOWER WILLAMETTE GROUP

PORTLAND HARBOR RI/FS

ROUND 3B COMPREHENSIVE SEDIMENT AND BIOASSAY TESTING FIELD SAMPLING REPORT

DRAFT

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Prepared for
The Lower Willamette Group

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ARI	Analytical Resources, Inc.
CAS	Columbia Analytical Services
CORS	continuously operating reference station
DGPS	differential global positioning system
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
EQuIS	Environmental Quality Information System
FSP	field sampling plan
FSR	field sampling report
LWG	Lower Willamette Group
LWR	lower Willamette River
MSS	Marine Sampling Systems
NAD83	North American Datum of 1983
NAS	Northwestern Aquatic Services
NOAA	National Oceanic and Atmospheric Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
QAPP	quality assurance project plan
RI/FS	remedial investigation and feasibility study
RM	river mile
R/V	research vessel
SVOC	semivolatile organic compound
SDG	sample delivery group
SICT	Seepage Inducted Consolidation Test
TOC	total organic carbon
TS	total solids
TPH	total petroleum hydrocarbon

1.0 INTRODUCTION

This field sampling report (FSR) summarizes the Round 3B sediment and bioassay field sampling activities that were conducted from November 13 through January 17, 2008. These Round 3B data supplement the Round 1, Round 2, and Round 3A sediment and bioassay data, and represent the final collection effort conducted as part of the remedial investigation and risk assessments for the Portland Harbor Superfund Site (Site).

The Round 3B sediment and bioassay field sampling activities were intended to collect data to address the data gaps related to site characterization, ecological and human health risks, and the FS. Round 3B sampling efforts included surface sediment chemistry, subsurface sediment chemistry, subsurface sediment physical data, and surface sediment bioassays focused within river mile (RM) 2 to RM 11 (i.e., the Study Area) of the lower Willamette River (LWR), including the upstream reach to RM 12.2. Additional sampling occurred in the upriver area (RM 15.3 to RM 26), between Ross Island and Willamette Falls, and within the Multnomah Channel.

Except where noted, all Round 3B surface and subsurface sediment field activities, including vessel positioning, sample collection, sample handling and processing, and data management, followed guidelines specified in the Round 3B Field Sampling Plan for Comprehensive Sediment and Bioassay Sampling (Round 3B Sediment FSP; Integral 2007b), the Round 2 Quality Assurance Project Plan (QAPP; Integral and Windward 2004) and QAPP Addendum 10 (Integral 2007a), the Round 2 Health and Safety Plan (Integral 2004), and the Round 3B Sediment Sampling and Benthic Toxicity Testing Health and Safety Plan (Windward 2007).

1.1 ROUND 3B SAMPLING OBJECTIVES

As detailed in the Round 3B Sediment FSP, the sediment and bioassay sampling efforts during this field effort supported the following remedial investigation/feasibility study (RI/FS) objectives:

- Collect synoptic and toxicity data to characterize risks to the benthic community
- Collect surface sediment chemistry data from the upriver reach of the LWR (RM 15.3- RM 26) to further characterize the upriver reach and assist in the determination of final background sediment concentrations
- Collect surface sediment chemistry data from Multnomah Channel to evaluate the potential for contaminant migration from the Study Area to Multnomah Channel
- Refine the lateral and vertical extent of sediment contamination associated with Lower Willamette Group (LWG) identified initial areas of potential concern (iAOPCs) as well as the U.S Environmental Protection Agency (EPA) identified Potential Risk Areas (EPA 2007), to support the RI and remedy evaluations in the FS

- Collect subsurface sediment chemistry data within the Study Area to further characterize subsurface sediment in areas where subsurface sediments posing potentially unacceptable risk may be exposed by future extreme high-flow flood events
- Collect geotechnical information on sediments to assist in determining the dredging and capping properties of sediments.

1.2 REPORT ORGANIZATION

The remaining sections of this document describe the field collection and sampling procedures used during the Round 3B comprehensive sediment sampling. Section 2 provides the chronology of sampling activities that took place during this phase of sampling. Section 3 describes the field sampling methods, quality assurance/quality control (QA/QC) samples, and deviations from the FSP and QAPP. Section 4 discusses chemical analyses and bioassay tests that will be performed for the sediment samples. Reporting requirements are described in Section 5, with cited references listed in Section 6. Supporting information is provided in five appendices:

- **Appendix A:** EPA – LWG Communications
- **Appendix B:** Field Log Sheets
- **Appendix C:** Grab Description Forms
- **Appendix D:** Core Description Forms
- **Appendix E:** Core Photographs (Found on Accompanying DVD).

2.0 CHRONOLOGY OF ROUND 3B COMPREHENSIVE SEDIMENT AND BIOASSAY SAMPLING

Surface and subsurface sediment samples were collected during Round 3B from November 13 to January 17, 2008, in three separate reaches within the Willamette River: Study Area from RM 2 to RM 11.2, including the upstream reach to RM 12.2, the upper reach of the Multnomah Channel (Figure 2-1a-l), and upriver from RM 15.3 to RM 26 (Figure 2-2a-d). Surface sediment grabs were collected at 188 locations and subsurface cores were collected at 88 of the 218 locations within these reaches.

3.0 FIELD SAMPLING PROCEDURES

The following sections describe the detailed procedures and methods used during Round 3B sediment and bioassay collection, including navigation and station positioning, sampling procedures, record keeping, sample handling, storage, and field QC procedures. Locations sampled during Round 3B are shown on Figures 2-1a-l and 2-2a-d, and are listed in Table 3-1. Tables 3-2 and 3-4 list the analyses for all samples collected. Tables 3-3 and 3-5 list the stations, sample collection measurements, collection and processing dates and times, and relevant comments regarding sampling. Tables 3-6 and 3-7 present the QA/QC sample list and summary, and Table 3-8 lists the station positioning changes and rationale relative to the FSP.

3.1 SAMPLING VESSELS

Marine Sampling Systems (MSS), Burley, WA, and Gravity Environmental LLC (Gravity), Snoqualmie, WA, provided the sampling vessels for the sediment sampling program. The MSS research vessel (R/V) *Nancy Anne* is a flat-deck, 36-ft-long catamaran with twin, 120-horsepower engines. It is equipped with a hydraulically operated A-frame with a boom and a 3,000-lb capacity hydraulic winch. The vessel draft ranges from 18 inches forward to 42 inches aft, and the vessel was used to deploy a hydraulic power grab for surface sediment sampling and a vibracore for the subsurface sediment sampling.

MSS also provided R/V *Peter R*, a flat-deck, 26-ft-long single hull vessel with twin, 120-horsepower engines, as the power grab deployment vessel. The vessel is equipped with a hydraulically operated A-frame with a boom, a 1,000-lb capacity hydraulic winch, and a computer-integrated differential global positioning system (DGPS) and NobelTech™ navigation system.

Gravity provided R/V *RM-RV2*, an open water jet boat equipped with two hydraulic winches and an articulating A-frame for deploying equipment through the boat's forward bow door and a computer-integrated DGPS and Trimble Terrasync™ navigation system. The *RM-RV2* was used to collect 14-ft cores during the planned absence of the R/V *Nancy Anne*.

3.2 NAVIGATION AND STATION POSITIONING

Navigation and station positioning were provided by MSS aboard the R/V *Nancy Anne* and R/V *Peter R.* and by Gravity Environmental aboard the R/V *RM-RV2* using a computer-integrated DGPS and navigation system. Positional accuracies of ±3 meters were achieved with this navigation system. The DGPS antenna was situated over the sampling gear to achieve the most accurate position for each sample. A position was recorded when the sampling device first impacted the sediment surface. Horizontal positions were acquired using a Trimble AG132 DGPS. Real-time differential

corrections were obtained from the continuously operating reference station (CORS) site at Appleton, WA.

On the sampling vessel, the Trimble GPS receiver output the station position to the integrated navigation software package. The GPS receiver displayed and transmitted data to the computer in North American Datum 1983 (NAD83) geographic coordinates (latitude/longitude). The integrated navigation system displayed the vessel's position relative to a target sampling location in plan view on a video screen. The screen display and numeric navigation data, including range and bearing to the target sampling location, assisted the vessel operator in approaching and maintaining a station position while sampling.

Vertical positioning was required to establish the elevation of the riverbed at each sampling location. While the sampling vessel maintained location, depth to mudline was measured using either a lead line or shipboard fathometer immediately prior to or during the sampling. Vertical measurements were recorded to the nearest 0.1 ft. Water depths were converted to elevations (feet Columbia River Datum) based on the river stage at the time of sampling as recorded at the Morrison Street Bridge.

3.3 SEDIMENT SAMPLING COLLECTION PROCEDURES

Two methods of sediment collection were used during Round 3B sediment and bioassay sampling:

- Surface sediment sampling using a power grab for contaminant chemical and bioassay analyses
- Subsurface sediment sampling using a vibracore for contaminant chemical analyses.

Round 3B sample collection and processing procedures followed guidelines specified in the Round 3B Sediment FSP (Integral 2007b), the Round 2 QAPP (Integral and Windward 2004), and QAPP Addendum 10 (Integral 2007a). Deviations from the FSP are discussed in Section 3.11.

3.3.1 Surface Sediment

A total of 188 surface sediment samples were collected from 188 locations during Round 3B. Including field replicates and split samples, 204 surface sediment samples were submitted for chemical analyses, and 60 sediment samples were collected for bioassay testing from the 188 surface locations. Samples submitted for chemical and/or physical analyses are listed in Table 3-2.

Surface sediment samples were collected in a consistent, repeatable manner with a stainless-steel, 0.3-m^2 hydraulic power grab sampler provided by MSS. The power grab sampler was attached to the winch cable with a ball-bearing swivel to prevent twisting

movements during deployment. The device was raised and lowered through the water column by the vessel's winch at a rate no greater than 20 meters per minute. This ensured that the sampler did not flip over on descent and prevented disturbance of the sediment surface upon retrieval. The maximum penetration of the power grab sampler was 30 cm, and a minimum penetration of 17 cm constituted an acceptable grab.

Once the sampler was brought on board, it was placed on a stand. Access doors on the top of the sampler were opened and sample acceptability was visually assessed. If the sample was acceptable, overlying water was then siphoned from the grab using clean tubing.

Sampling personnel maintained the field logs as each surface sediment sample was collected. Copies of these field logs are presented in Appendix B. The following information was recorded on the grab description forms:

- **Date/Time.** The date and time (local) when the sediment sample was collected.
- **Depth to Mudline.** Water depth at the sampling station.
- **Total Grab Penetration.** The depth of penetration (cm) into the subsurface.
- **Sediment Observations.** The average sediment texture, color, notable odors, debris, etc. observed at each of the cut ends of the core sections.

Table 3-3 summarizes the above information, and the sediment observations are recorded on the grab description forms in Appendix C.

Because an undisturbed sediment surface is necessary for chemical sampling, the physical characterization of the sediment in the grab sample was delayed until after the chemical samples had been collected. Sediment for physical (e.g., grain size) and chemical analyses was collected using a stainless-steel spoon or spatula. Sediment that was in contact with the sides of the sampler was not sampled. Large organisms and pieces of debris were removed and noted in the sample log sheet. The sediment sample was then placed into a stainless-steel mixing bowl for homogenization. A minimum of a 2.5-liter sample size was required for all chemical analyses. A single cast of the power grab provided adequate sediment volume.

3.3.2 Subsurface Sediment

A total of 94 subsurface sediment cores were collected from 88 stations during Round 3B. The difference between the number of cores and number of stations is due to additional QC cores collected at the same station. Including field replicates and homogenate split samples, a total of 244 subsurface sediment samples were submitted for chemical and/or physical analyses. Samples submitted for chemical and/or physical analyses are listed in Table 3-4.

Subsurface sediment cores were collected over water using a vessel-deployed customized vibracore. The vibracore was equipped with 14-ft or 20-ft-long aluminum core tube (4-inch diameter). The vibracorer used a hydraulic system that vibrates and drives the aluminum core tube into the sediment. A continuous sediment sample is retained within the tubing with the aid of a stainless-steel core cutter/catcher attached to the bottom of each aluminum tube. A core liner is not used with this device.

At each core station, a single core was driven to the maximum core tube length or the refusal depth. Depth to refusal (the maximum depth the vibracore can be driven into the bottom) and core sample recovery are functions of location-specific sediment textures and stratigraphy.

Including 6 field replicates, 56 cores were collected from the Study Area and Multnomah Channel for chemistry analyses, 23 cores were collected in the Study Area for erosion study analyses, 5 cores were collected in the Study Area for both chemistry and erosion study analyses, and 10 cores were collected in the Study Area for geotechnical analyses (Table 3-3).

Cores for contaminant chemistry, erosion study and geotechnical analyses were cut into manageable sections (3-4 ft) aboard the vessel immediately after their retrieval.

The cutter head at the bottom of the core tube was typically removed. The resulting sampled core lengths (net recovery) ranged from 32 to 99.7% of the drive lengths (Table 3-5). Of the 94 cores, 73 (78%) showed recoveries of 70% or more of the drive length.

Sampling personnel maintained the field logs as each core was collected. Copies of these field logs are presented in Appendix B. The following information was recorded on the core logs:

- **Date/Time.** The date and time (local) when vibracoring commenced at each station.
- **Depth to Mudline.** Water depth at the sampling station.
- **Total Drive Length.** The depth of core tube penetration into the subsurface.
- **Recovered Length.** The thickness of the sediment column retained in the core tube prior to sectioning and removal of the core catcher at the base of the tube.
- **Sediment Observations.** The average grain size, color, notable odors, debris, etc. observed at each of the cut ends of the core sections.

Table 3-5 summarizes the above information, and the sediment observations are included in the core description forms presented in Appendix D.

The cores were transferred upright from the sampling vessel to the core processing lab twice daily and were stored upright in lab refrigerators until processing.

Copies of all field log sheets and sample description forms are provided in Appendices B and D. Core photos are provided in Appendix E (found on accompanying DVD). Original sample log sheets and core photos are on file in the LWG Project Library at Integral's office in Portland, OR.

3.4 SAMPLE HANDLING AND PROCESSING

At the core processing lab, all cores were opened using a table saw according to the methods described in the Round 3B Sediment FSP. Deviations from the sample handling and processing methods described in the FSP are presented in Section 3.11.2.

After the sediment in all segments of a core was exposed, the subsurface sample intervals were determined, based primarily on lithology and the minimum (1 ft) and maximum (approximately 4 ft) core length criteria for chemistry and erosion cores as stated in the Round 3B Sediment FSP. Representative samples for headspace screening were collected directly from each sample interval as soon as possible following the core exposure. For geotechnical cores, both a geologist and a geotechnical engineer logged the cores and determined the intervals for the cores. Geotechnical samples were collected from these intervals and stored at 4°C prior to being sent to Analytical Resources, Inc. Laboratories (ARI, Tukwila, WA) for geotechnical indexing and the Seepage Induced Consolidation Test (SICT).

The core segments were photographed, and core descriptions were recorded on sediment core log forms using the criteria described in Section 4.6.2 of Integral (2007b). Following core description, the sediment from each sample interval was collected and homogenized using individual decontaminated stainless-steel bowls and spoons. All cores were subsampled vertically, with no compositing of sediment from adjacent cores. Sample intervals were selected to be either analyzed or archived based on the criteria described in Section 2.2.1 of Integral (2007b).

Sediment from each sample interval was transferred following homogenization into glass sample jars provided by the analytical laboratories. Sample jars were capped, labeled, bagged individually, and stored in lab refrigerators.

3.5 SAMPLE IDENTIFICATION SCHEME

All samples were assigned a unique identification code, as described in the Round 3B Sediment FSP, based on a sample designation scheme designed to meet the needs of field personnel, data management, and data users. Any deviations from this plan are outlined in Section 3.11.2. Sample identification numbers for each target location are listed in Tables 3-1 through 3-5.

3.6 EQUIPMENT DECONTAMINATION PROCEDURES

Decontamination procedures for all nondedicated (reusable) sampling equipment (e.g., bowls, spoons) followed procedures outlined in Integral (2007b):

- Rinse with site water.
- Wash with brush and Alconox™ or other phosphate-free detergent.
- Double rinse with distilled water.
- Rinse with 0.1 N nitric acid.
- Rinse with deionized water.
- Rinse with methanol (omit if sampling for volatiles).

The sediment grab samplers were rinsed between stations with site water. If the grab sampler contacted visibly contaminated sediment, it was thoroughly washed using Alconox™ or other phosphate-free detergent and rinsed with site water before sampling a new station. If a residual creosote or petroleum sheen remained on the sampling equipment or was difficult to remove using the standard decontamination procedures above, a final hexane rinse was added.

Decontamination of stainless-steel bowls and utensils was performed before sampling and between each composite sample. Sample handling equipment also was wrapped in aluminum foil following the methanol rinse. Before being used to remove sediment from the samplers, all equipment was rinsed with deionized water. Sample handling equipment was wrapped in aluminum foil following the final deionized water rinse. To minimize sample contamination, gloves were replaced or thoroughly washed using Alconox™ or other phosphate-free detergent and rinsed with distilled water before and after handling each sample. Rinse waters were disposed of through the field laboratory's sanitary sewer.

The station-dedicated core tubes were decontaminated by MSS prior to mobilization to the site. The aluminum core tubes were washed in an Alconox™ solution bath, and the tube interiors were scrubbed with an abrasive pad. The core cutter heads were washed in an acid solution, rinsed with potable water, and then washed with an Alconox™ solution. Both the tubes and core cutter heads were given a final rinse with potable water and were capped until used.

3.7 FIELD QUALITY ASSURANCE/QUALITY CONTROL

The types of QA/QC samples that were collected during this phase of the Round 3B sampling program are described below. The numbers of QC samples collected per analyte are listed in Tables 3-6 and 3-7. Any deviations from the field QA/QC outlined in Integral (2007b) are presented in Section 3.11.3.

3.7.1 Field Replicates

Replicate samples were analyzed from field replicate grabs and cores collected at approximately 5% of the 3B chemistry and erosion study sampling stations, as indicated by the "-2" ID extension in Tables 3-2 through Table 3-5. Replicates are samples from a second core or grab collected at a station to allow assessment of within-station variability. Field replicates were generated by collecting an additional core or grab at the sampling location, not by subsampling the samples from the original core or grab.

3.7.2 Field Splits

Field split samples were analyzed at approximately 50% of the stations where field replicates are collected, or approximately 2.5% of the total Round 3B stations, as indicated by the "-3" ID extension in (Tables 3-2 through 3-4). Split samples are multiple samples taken from a replicate sample single composite after it is fully homogenized. The resulting data provide information on the variability associated with sample handling and laboratory analysis operations. No replicate samples and therefore no field split samples were collected for the bioassay or geotechnical analyses as outlined in the Round 3B Sediment FSP.

3.7.3 Rinsate, Temperature, and Field Trip Blanks

Introduction of chemical contaminants during sampling and analytical activities was assessed by the analysis of blanks. Rinsate blanks, consisting of sampling equipment rinsates, were generated for all chemical parameter groups at a frequency of at least 5% of the sediment samples submitted for analysis to the laboratory. The chemical analyses for the rinsate samples are shown in Table 3-6.

Temperature blanks are used to measure and ensure cooler temperature upon receipt to the laboratory. One temperature blank was prepared and submitted with each cooler shipped to the analytical laboratory. The temperature blank consisted of a sample jar containing deionized water that was packed into the cooler in the same manner as the rest of the samples and labeled "temp blank."

Field trip blanks are used to determine if volatile chemicals are introduced to samples during holding or storage prior to analysis. One trip blank was included with each cooler containing samples for analysis of sulfides. The field trip blanks consisted of deionized water sealed in a sample container by the analytical laboratory. The trip blank was generated and transported to and from the field and then returned to the laboratory unopened for analysis.

3.8 SAMPLE STORAGE, TRANSPORT, AND CUSTODY

Filled sample jars were stored in the field lab refrigerators before the jars were transferred to the analytical laboratory. Glass jars were packed to prevent breakage and separated in

the shipping container by bubble wrap or other shock-absorbent material. Ice in sealed plastic bags or "blue ice" was then placed in the shipping cooler to maintain a temperature of approximately 4ºC.

The coolers were clearly labeled with sufficient information to enable positive identification. A chain-of-custody form was placed into a resealable plastic bag and taped on the inside lid of the cooler. A temperature blank was added to each cooler as well as a trip blank for samples for sulfide analyses. Each ice chest was sealed with three chain-of-custody seals. Coolers were transported to the laboratory by courier or overnight shipping service.

3.9 FIELD DOCUMENTATION

All field activities and observations were noted in a bound field logbook and/or individual field and sample log forms during fieldwork. Information included personnel, date, time, station designation, sampler, types of samples collected, and general observations. Any changes that occurred at the site (e.g., personnel, responsibilities, deviations from the FSP) and the reasons for these changes were documented.

A sample collection checklist was produced prior to sampling and completed following sampling operations at each station. The checklist included station designations, types of samples to be collected, and whether blind field replicates or additional sample volumes for laboratory QC analyses were collected.

Field data sheets and core description forms were completed for all stations and kept in the project file. Field log sheets are presented in Appendix B, surface grab log sheets in Appendix C, core description forms in Appendix D, and core photographs are presented in Appendix E.

3.10 WASTE DISPOSAL

Any excess water or sediment remaining after processing in the field was returned to the river in the vicinity of the collection site. Any water or sediment spilled on the deck of the sampling vessel was washed into the surface waters at the collection site before proceeding to the next station. Sediment remaining after processing in the field laboratory was sealed in 55-gallon drums. A homogenized sample of this sediment has been collected and is being analyzed for disposal characterization before the drum is sent to the appropriate disposal facility.

All disposable materials used in sample processing were placed in heavyweight garbage bags and deposited in the field lab dumpster for disposal at a solid waste landfill. Liquid wastes from decontamination of the sampling equipment were disposed of into the sanitary sewer system. Used core tubes were washed and recycled.

Phosphate-free, detergent-bearing, liquid wastes from decontamination of the sampling equipment was washed overboard or disposed of into the sanitary sewer system. Waste solvent rinses were held in sealed plastic buckets and disposed of into the sanitary sewer. Any oily or other obviously contaminated investigation-derived waste was placed in appropriate containers, and a waste determination was made before it was disposed of at an appropriate facility.

3.11 FIELD DEVIATIONS FROM THE ROUND 3B SEDIMENT FSP, ROUND 2 QAPP, AND QAPP ADDENDUM 10

This section discusses Round 3B sampling deviations from the Round 3B Sediment FSP, the Round 2 QAPP, and QAPP Addendum 10.

3.11.1 Station Positioning Deviations

For stations where a surface grab sample was collected during the Round 3B surface sediment sampling program, coordinates of these surface samples served as the target location for the collocated subsurface stations. The target coordinates for noncollocated subsurface stations were selected from site maps per EPA direction. Field conditions and water depth requirements for the operation of the coring equipment occasionally made it necessary to move the subsurface sampling location away from the target coordinates. The target and actual sample coordinates for all sediment stations are included in Tables 3-1 and 3-8.

Cores and grabs that were collected more than approximately 50 ft from their planned target location or that were abandoned due to field conditions are listed in Table 3-8. Table 3-8 also includes the distance and direction of each of these stations from the target location and the rationale for the location changes. EPA was consulted on changes for several of these locations, and the tables identifies the relevant Appendix A communications and decisions regarding the individual location changes. Location changes to samples C626, G641, C688, C708, and C724 were not discussed with EPA and were made on the basis of minimum water depth necessary for core sampling, obstacles at the locations (dry dock), and the presence of riprap and wood debris at the sampling location.

3.11.2 Sample Collection and Processing Deviations

Changes in the proposed station sampling approach (such as core length changes, station additions/deletions) are noted in Table 3-5. All appropriate EPA – LWG communications for the following deviations can be found in Appendix A.

Listed below are additional deviations from the Round 3B Sediment FSP regarding sample processing:

- The Round 3B Sediment FSP called for cores to be placed in a stainless-steel tray during the description and sampling process; however, in the field laboratory they were placed on an aluminum-foil-covered table, with the aluminum changed between cores. This method is consistent with the Rounds 2 (Integral 2005) and 3A (Integral 2006) core processing procedures.
- Although care was taken to avoid sampling sediment in contact with the inner surface of the core tubes, insufficient volume or the cohesiveness of the sediment sometimes necessitated collecting this material.
- A surface grab log sheet from November 30, 2007 was swept from the sampling vessel into the river during poor weather, and could not be retrieved. This log sheet contained the full descriptions of grabs LW3-730, LW3-731, LW3-732-1, LW3-732-2 and LW3-734. The data from these logs, apart from the sediment description, is duplicated in the field notebook, and were used to complete Table 3-4.
- Chemistry analyses were conducted according to the Round 3B Sediment FSP, although the full analyses (Table 3-3) were conducted on the archived sediment samples for the following subsurface samples: MC002D, MC006D, MC008D, C602D, C604D, C613E, C614D, C636D & C658D. These are the lowest intervals within their respective cores, and were initially archived during sample processing. Full chemistry analyses were later conducted on the archived sediment samples to better assess the potential contaminant concentrations with depth at these core locations.
- After multiple attempts, surface grab sample G782 was abandoned, although the 'A' interval of collocated core C782 was submitted for full chemical and physical analyses (Appendix A7).
- All subsurface core segment photographs (Appendix E) were taken according to the Round 3B Sediment FSP, except that photographs for core C704 were incorrectly labeled E704, photographs for core C712 were incorrectly labeled E712, photographs for core C648 were incorrectly labeled C648A, and photographs for core C733 were incorrectly labeled E733.

3.11.3 Quality Assurance/Quality Control Deviations

All QA/QC requirements for the subsurface samples were met, with few exceptions as follows:

- Replicate samples were collected at or above 5% for all surface sediment sampling stations, and at or above 5% for all subsurface intervals except for polychlorinated biphenyl (PCB) congeners, which were collected at 3.2% of the subsurface intervals.

4.0 LABORATORY ANALYSES

This section summarizes the chemical analyses that will be performed for the characterization of sediment and bioassay samples from the Round 3B sampling event. Table 4-1 and Table A6-3 of QAPP Addendum 10 (Integral 2007a) list the analytical methods to be used on each sample. Laboratory deviations will be reported in the Round 3B Comprehensive Sediment and Bioassay Data Report.

4.1 PHYSICAL AND CHEMICAL ANALYSES

Columbia Analytical Services (CAS, Kelso, WA and Houston, TX) will conduct the physical and chemical analyses for surface and subsurface chemistry samples. Round 3B surface, subsurface, and bioassay sediment samples will be analyzed for the following constituents:

- Conventional analyses (total organic carbon, total solids, grain size, and specific gravity)
- PCB congeners
- PCB Aroclors
- Organochlorine pesticides
- Semivolatile organic compounds (SVOCs, including polycyclic aromatic hydrocarbons [PAHs], phthalates, and the remaining SVOCs listed in the Round 2 QAPP)
- Alkylated PAHs
- Metals, including mercury
- Dioxins and furans
- Total petroleum hydrocarbons (diesel-, gasoline-, and oil-range TPH)
- Geotechnical analyses (Atterberg limits, moisture content, grain size, specific gravity, settlement properties, and SICT).

Vista Analytical (El Dorado Hills, CA) will perform the analyses of PCB congeners. ARI (Tukwila, WA) and the University of Colorado will conduct all geophysical analyses. Northwestern Aquatic Sciences (NAS, Newport, OR) will perform all bioassay testing, including 28-day *Hyalella* and 10-day *Chironomus* tests. Aliquots from each surface and core segment composite were collected and archived frozen for possible future analyses.

4.2 DATA MANAGEMENT

Once the laboratories have completed their internal QA/QC checks, they export the analytical data (sample, test, batch, and result information) into comma-delimited text files with data columns arranged in an order that is recognized by the project's Environmental Quality Information System (EQuIS) database. These electronic data deliverables (EDDs) are e-mailed to Integral where they are checked for proper EQuIS structure and appended with specific information that was unknown by the labs, such as sampling location, composite information, and field replicate and split information. If any problems are found in the structure of the EDDs, then the laboratory is notified and asked to correct the problem and resubmit the EDD. Each e-mailed EDD transmission, with the original, unaltered EDD attachment, is stored to document and track the laboratories' delivery of electronic data to Integral.

When the EDDs are correct and complete, they are checked electronically by loading them into the temporary section of Integral's LWG project database. In the process of loading, EQuIS checks the EDDs for correct lookup codes (such as for analytes, test methods, and sample matrices); proper relationships for results, tests, batches, and samples (to ensure all results match with a test, tests with samples, and sample/test pairs with batches); and that all derived samples (such as replicates, splits, and matrix spikes) have corresponding parent samples. In addition to these checks, EQuIS also checks "less important" characteristics, such as date and time formats and text field lengths, to ensure consistency throughout the database.

Any error prevents the EDD from loading until the error is corrected. If errors are found that are related to the way the laboratory is reporting the data or constructing the EDD, then the laboratory is notified and asked to correct the problem and resubmit the EDD. If errors are related to Excel automatically formatting date and time fields, for example, then the error is corrected, and steps are taken to avoid repeats of the problem (such as changing default settings in the software). Each successfully loaded EDD is stored as loaded to document and track the data that are loaded into the LWG project database.

Each verified and accurate EDD is provided to the Round 3 data validation contractor (EcoChem, Seattle, WA) for data review and validation. These EDDs are also stored in a temporary section of the project database where they can be queried and examined, if desired, until validation is complete. As EcoChem completes validation of the data by sample delivery group (SDG) or small groups of SDGs, the validation qualifiers and reason codes are applied to the data in the temporary section of the database. The validated data are then merged into the permanent project database. During the merging process, all previously performed electronic checks are repeated to ensure nothing was incorrectly modified with the application of the validation results.

Several queries have been set up in the permanent project database to translate the data structure to a form compatible with the National Oceanic and Atmospheric Administration's (NOAA) Query Manager. The data translation includes creating station and sample identifiers, converting the sample type code, and changing the date format.

The translated data are imported into an Access file provided by NOAA that contained template tables for the Query Manager structure.

Integral's LWG project database contains all of the data reported by the analytical laboratories. This includes field and lab replicates, lab dilutions, results for the same analyte from multiple analytical methods (e.g., hexachlorobenzene by EPA methods 8081A and 8270), and laboratory QC samples such as matrix spikes, surrogates, and method blanks.

5.0 REPORTING

LWG-validated analytical laboratory data will be provided to EPA in an electronic format within 150 days of completion of the sampling event. Sediment chemistry and bioassay results will be reported in tabular format in the Round 3B Comprehensive Sediment and Bioassay Data Report, which will be developed within 90 days after the data have been validated. These data will also be incorporated into the RI report and baseline risk assessments, which will be prepared after all sampling and analysis rounds for the project are completed.

6.0 REFERENCES

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